

WHAT IS CLAIMED IS:

1. A branch amplifier card for a nuclear reactor control rod drive control system, the control system comprising a control processor, a plurality of transponder cards arranged in clusters, each cluster under the control of a branch amplifier card, said branch amplifier card configured to:

receive commands from the control processor;

send the converted commands to transponder cards under the control of the branch amplifier card and to a downstream branch amplifier card;

receive an acknowledge word from transponder cards under the control of the branch amplifier card ;

add AC voltage threshold level information about the transponder cards under the control of the branch amplifier card to the acknowledge word;

permit transponder trouble information attached to the acknowledge word to remain in the acknowledge word; and

resend the acknowledge word including the transponder trouble information to an upstream branch amplifier card.

2. A branch amplifier card in accordance with Claim 1 wherein said branch amplifier card is further configured to:

receive a differential command word from an upstream branch amplifier; and

resend the command word as a differential signal to a downstream branch amplifier.

3. A branch amplifier card in accordance with Claim 1 wherein said branch amplifier card is further configured to:

receive a differential acknowledge word from a downstream branch amplifier card; and

resend the acknowledge word as a differential signal to an upstream branch amplifier card.

4. A branch amplifier card in accordance with Claim 3 wherein said branch amplifier card is further configured to:

buffer the command word differential signal; and

send the command word as a single ended signal to the transponder cards under the control of the branch amplifier card.

5. A branch amplifier card in accordance with Claim 1 wherein said branch amplifier card is further configured to:

receive a single ended signal acknowledge word from the transponder cards under the control of the branch amplifier card;

convert the single ended signal acknowledge word to a differential signal acknowledge word; and

send the differential signal acknowledge word to an upstream branch amplifier card.

6. A branch amplifier card in accordance with Claim 1 wherein said branch amplifier card is further configured to provide automatic switching of an acknowledge word such that a defective acknowledge word from a transponder card does not prevent the reception and retransmission of acknowledge words from downstream branch amplifier cards to upstream branch amplifier cards.

7. A nuclear reactor control rod drive control system, the nuclear reactor including a plurality of control rods, said control system comprising:

a control processor;

a plurality of control rod drives, each said control rod drive configured to connect to a control rod;

an hydraulic control unit connected to each said control rod drive, said hydraulic control unit comprising a transponder card; and

a plurality of branch amplifier cards operationally connected to said control processor and to each other, each said branch amplifier operationally connected to and controlling a cluster of transponder cards, said branch amplifier card configured to:

receive commands from said control processor;

send the converted commands to transponder cards under the control of said branch amplifier card and to a downstream branch amplifier card;

receive an acknowledge word from transponder cards under the control of said branch amplifier card ;

add AC voltage threshold level information about said transponder cards under the control of said branch amplifier card to the acknowledge word;

permit transponder trouble information attached to the acknowledge word to remain in the acknowledge word; and

resend the acknowledge word including the transponder trouble information to an upstream branch amplifier card.

8. A control system in accordance with Claim 7 wherein said branch amplifier card is further configured to:

receive a differential command word from an upstream branch amplifier; and

resend the command word as a differential signal to a downstream branch amplifier.

9. A control system in accordance with Claim 7 wherein said branch amplifier card is further configured to:

receive a differential acknowledge word from a downstream branch amplifier card; and

resend the acknowledge word as a differential signal to an upstream branch amplifier card.

10. A control system in accordance with Claim 9 wherein said branch amplifier card is further configured to:

buffer the command word differential signal; and

send the command word as a single ended signal to said transponder cards under the control of said branch amplifier card.

11. A control system in accordance with Claim 7 wherein said branch amplifier card is further configured to:

receive a single ended signal acknowledge word from said transponder cards under the control of said branch amplifier card;

convert the single ended signal acknowledge word to a differential signal acknowledge word; and

send the differential signal acknowledge word to an upstream branch amplifier card.

12. A control system in accordance with Claim 7 wherein said branch amplifier card is further configured to provide automatic switching of an acknowledge word such that a defective acknowledge word from a transponder card does not prevent the reception and retransmission of acknowledge words from downstream branch amplifier cards to upstream branch amplifier cards.

13. A nuclear reactor comprising:

a reactor pressure vessel;

a reactor core located inside said reactor pressure vessel, said core comprising a plurality of fuel assemblies and a plurality of control rods; and

control rod drive control system comprising:

a control processor;

a plurality of control rod drives, each said control rod drive connected to a control rod;

an hydraulic control unit connected to each said control rod drive, said hydraulic control unit comprising a transponder card; and

a plurality of branch amplifier cards operationally connected to said control processor and to each other, each said branch amplifier operationally connected to and controlling a cluster of transponder cards, said branch amplifier card configured to:

receive commands from said control processor;

send the converted commands to transponder cards under the control of said branch amplifier card and to a downstream branch amplifier card;

receive an acknowledge word from transponder cards under the control of said branch amplifier card ;

add AC voltage threshold level information about said transponder cards under the control of said branch amplifier card to the acknowledge word;

permit transponder trouble information attached to the acknowledge word to remain in the acknowledge word; and

resend the acknowledge word including the transponder trouble information to an upstream branch amplifier card.

14. A nuclear reactor in accordance with Claim 13 wherein said branch amplifier card is further configured to:

receive a differential command word from an upstream branch amplifier; and

resend the command word as a differential signal to a downstream branch amplifier.

15. A nuclear reactor in accordance with Claim 13 wherein said branch amplifier card is further configured to:

receive a differential acknowledge word from a downstream branch amplifier card; and

resend the acknowledge word as a differential signal to an upstream branch amplifier card.

16. A nuclear reactor in accordance with Claim 15 wherein said branch amplifier card is further configured to:

buffer the command word differential signal; and

send the command word as a single ended signal to said transponder cards under the control of said branch amplifier card.

17. A nuclear reactor in accordance with Claim 13 wherein said branch amplifier card is further configured to:

receive a single ended signal acknowledge word from said transponder cards under the control of said branch amplifier card;

convert the single ended signal acknowledge word to a differential signal acknowledge word; and

send the differential signal acknowledge word to an upstream branch amplifier card.

18. A nuclear reactor in accordance with Claim 13 wherein said branch amplifier card is further configured to provide automatic switching of an acknowledge word such that a defective acknowledge word from a transponder card does not prevent the reception and retransmission of acknowledge words from downstream branch amplifier cards to upstream branch amplifier cards.